APPENDIX E. AIR QUALITY

CONTENTS

Emissions from Live-fire Training Exercises at IPBC E-1
Fugitive Dust Emissions from Construction Activities E-11
Construction Vehicle and Equipment Emissions E-12
Emissions from Employee Commuting (POVs) E-15

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This Appendix includes additional information on the methodology used to calculate both criteria pollutant and greenhouse gas (GHG) emissions for the sources at the proposed test locations analyzed in greater detail for this PEIS. Summary tables for each major category of emission source for the Proposed Action are also included in this Appendix.

Major areas of emission estimates include:

- Ordnance and munitions from Soldiers and troops conducting live-fire training exercises at designed locations at the proposed IPBC,
- Fugitive dust emissions from proposed construction activities, and
- Emissions from personal commuter vehicles.

Emissions from Live-fire Training Exercises at IPBC

Live-fire training occurring at the IPBC would primarily consist of small arms ammunition and rocket fired ammunition from helicopters, which emit a minute amount of emissions per round from combustion of the propellant charge. A smaller percentage of ordnance with explosive or pyrotechnic components such as flares, smoke devices, and demolition charges is also used for some training exercises.

The primary criteria pollutant emissions from small arms firing include carbon monoxide (CO) and lead. CO is emitted as a combustion by-product from the detonation of the energetic material inside the ammunition. The energetic material in most small arms ammunition usually includes a small amount of a lead ingredient, which may be emitted into the atmosphere when the ammunition is fired. The projectile (slug) which is fired at the target also usually contains lead.

The amount of emissions generated from small arms firing is dependent on the type and quantity of ammunition rounds fired. The primary weapons and ammunition authorized for use by an IBCT on the IPBC range are listed in Table E.1, an SBCT in Table E.2, and a CAB in Table E.3. Additional weapons and ammunitions used at the IPBC are identified in Table E.4. Emissions calculated from this ordnance/ammunition use at the IPBC are provided in Table E.5.

Table E.1 Total IBCT Annual Ammunition Expenditures at the IPBC

Weapon Type	Ammunition Type	Ammo per weapon/ event[1]	Weapons per platoon[2]	Weapons per company[2]	Weapons per battalion[2]	Weapons per BCT[3]	Annual expenditures (2 events/yr)
Rifle Squads							
M16 / M4 Rifle	5.56 BALL	150	24	75	225	642	192,600
	5.56 BLANK	300	24	75	225	642	385,200
M249 SAW	5.56 BALL	300	6	18	54	120	72,000
	5.56 BLANK	600	6	18	54	120	144,000
M203 40mm Grenade Launcher	40 MM TPT	18	7	21	91	228	8,208
Weapons Squad							
M16/M4 Rifle	5.56 BALL	150	7	21 Rifle CO / 48 WPN CO	111	222	66,600
	5.56 BLANK	300	7	21 Rifle CO / 48 WPN CO	111	222	133,200
M240B	7.62 BALL	300	2	6 Rifle CO / 6 WPN CO	36	98	58,800
	7.62 BLANK	600	2	6 Rifle CO / 6 WPN CO	36	98	117,600
M2 Machine Gun	.50 CAL BALL	75	2	8	15	50	7,500
MK19	40 MM TPT	5	1	4	8	28	280
Engineer Platoon							
M16 / M4	5.56 BALL	150	12			36	10,800
M249	5.56 BALL	300	2			6	3,600
M240	7.62 BALL	300	1			3	1,800
M2	.50 CAL BALL	100	1			3	600

[1]Ammunition required per IBCT training event is derived from the Platoon/Company level ammunition allocations which are set forth in Standards in Weapons Training, Department of Army Pamphlet 350-38.

[2]The weapons per Platoon, Company, and Battalion are derived from the organizational structure of the Brigade's two Rifle Battalions.

[3]The total number reflects the weapons authorized in the Brigade's two Rifle Battalions and the Cavalry Squadron.

Table E.2. Total SBCT Annual Ammunition Expenditures at the IPBC[1]

Weapon Type	Ammunition Type	Ammo per weapon/ event[2]	Weapons per platoon[3]	Weapons per company[3]	Weapons per battalion[3]	Weapons per BCT[4]	Annual expenditures (2 events/yr)
Rifle Squads							
M16 / M4 Rifle	5.56 BALL	150	30	90	270	1,017	305,100
	5.56 BLANK	300	30	90	270	1,017	610,200
M249 SAW	5.56 BALL	300	6	18	54	162	97,200
	5.56 BLANK	600	6	18	54	162	194,400
M203 / M320 40mm Grenade Launcher	40 MM TPT	18	8	23	69	247	8,892
Weapons Squad							
M16 / M4 Rifle	5.56 BALL	150	7	21 Rifle CO / 48 WPN CO	111	333	99,900
	5.56 BLANK	300	7	21 Rifle CO / 48 WPN CO	111	333	199,800
M240B	7.62 BALL	300	2	6 Rifle CO / 6 WPN CO	24	72	43,200
	7.62 BLANK	600	2	6 Rifle CO / 6 WPN CO	24	72	86,400
M2 Machine Gun	.50 CAL BALL	75	5	16	49	165	24,750
MK 19	40 MM TPT	5	2	8	24	90	900
Engineer Platoon							
M16 / M4	5.56 BALL	150	12			36	10,800
M249	5.56 BALL	300	2			6	3,600
M240	7.62 BALL	300	1			3	1,800
M2	.50 CAL BALL	100	1			3	600
Mobile Gun System	.50 CAL (Slap-T)	10	3	3	9	27	540
	.50 CAL BALL	100	3	3	9	27	5,400

Weapon Type	Ammunition Type	Ammo per weapon/ event[2]	Weapons per platoon[3]	Weapons per company[3]	Weapons per battalion[3]	Weapons per BCT[4]	Annual expenditures (2 events/yr)
	7.62 CAL BALL	300	3	3	9	27	16,200

[1]The SBCT ammunition types are generally the same as the IBCT, with the exception of the MGS weapons/munitions which are only associated with the SBCT. However, the SBCT have different amounts of weapons and munitions than the IBCT based on a different manning and equipping structure.

[2]Ammunition required per SBCT training event is derived from the Platoon/Company level ammunition allocations which are set forth in Standards in Weapons Training, Department of Army Pamphlet 350-38.

[3]The weapons per Platoon, Company, and Battalion are derived from the organizational structure of the Brigade's Stryker Battalions.

[4]The total number reflects the weapons authorized in the Brigade's three Stryker Battalions and the Cavalry Squadron.

Table E.3. Total CAB Annual Ammunition Expenditures at the IPBC

Weapon Type	Ammunition Type	Ammo per weapon/ event[3]	Weapons per platoon[4]	Weapons per company[4]	Weapons per battalion[4]	Weapons per CAB[4]	Annual expenditures (2 events/yr)
Attack Helicopter Squadron (Light)[1]							
M274 / M 267	2.75 inch Rocket (Captive Trainer)	14	N/A	N/A	30	30	840
Assault Helicopter Squadron[2]							
M240	7.62 BALL	150	N/A	N/A	30	30	9,000

[1] 30 each OH-58 Kiowa Helicopters

[2] 30 each UH-60 Black Hawk Helicopters

[3] Ammunition required per CAB training event is derived from the Platoon/Company level ammunition allocations which are set forth in Standards in Weapons Training, Department of Army Pamphlet 350-38.

[4] The weapons per Platoon, Company, Battalion and Combat Aviation Brigade are derived from the organizational structure of the 25th CAB.

Table E.4. Additional Ammunition Expenditures at the IPBC

Weapon / Munitions Description	Projected Annual Expenditures
AT4 Launcher & Ctg 84mm (M136)	45
Smoke Pot Flt (M4A2)	48
BGM-71 TOW (Anti-Tank Missile)	9
Carl Gustav (recoilless rifle)	384
60mm Mortar, HE	660
60mm Mortar, Inert	283
81mm Mortar, HE	408
81mm Mortar, Inert	184
120mm Mortar, HE	876
120mm Mortar, Inert	528
Demolition, Bangalore, M026/M028/MP03	60
Demolition, C-4, M023	1,000
Mine, Claymore, K143/K146	6
Grenades	
Yellow/Green/Red/Violet Smoke Grenades	335
Grenade Frag M67 (G881)	510
Prac Fuze M228 (G878)	480
Grenade Body Inert M69 use with M228 Fuze (G811)	480
Pyrotechnics/Incendiaries	
Artillery Simulators	272
Grenade Simulators	272

Table E.5. Ammunition/Ordnance Emissions (tpy) at the IPBC

Type	SO_2	CO	NOx	PM_{10}	$PM_{2.5}$	CH_4	TSP	CO_2	TNMHC	Lead
Light Infantry IBCT	<0.01	0.54	0.03	0.02	0.01	<0.01	0.02	0.35	<0.01	<0.01
Light Infantry SBCT	<0.01	0.83	0.04	0.03	0.02	<0.01	0.03	0.52	<0.01	<0.01
Engineer Platoon IBCT	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Engineer Platoon SBCT	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Mobile Gun System	-	0.14	<0.01	<0.01	<0.01	<0.01	<0.01	0.73	<0.01	0.01
Attack Helicopter Squadron (Light)	-	0.22	-	0.07	0.07	<0.01	0.06	2.02	<0.01	0.03
Assault Helicopter Squadron	-	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total (tpy)	**<0.01**	**1.77**	**0.07**	**0.12**	**0.10**	**0.01**	**0.12**	**2.99**	**<0.01**	**0.03**

Emissions associated with each ammunition type used at the IPBC were calculated according the following equation:

$$\mathbf{E_{poll} = NR * EF_{poll}}$$

E_{poll} = Emissions pollutant (lb/yr)

NR = Number of rounds of a particular type of ammunition fired during the year

EF_{poll} = Pollutant emission factor (lb/item) [as shown in Table E.5]

Table E.6 identifies the emission factors from AP-42 Section 15 for the various ammunition types.

Table E.6. AP-42 Emissions Factors for Ordnance Use at IPBC

Weapon	Ammunition Type	SO_2 (lbs/item)	CO (lbs/item)	NOx (lbs/item)	PM_{10} (lbs/item)	$PM_{2.5}$ (lbs/item)	CH_4 (lbs/item)	TSP (lbs/item)	CO_2 (lbs/item)	TNMHC (lbs/item)	Lead (lbs/item)	AP-42 Source
M16 / M4	5.56 BALL	0	1.6E-03	8.5E-05	3.9E-05	2.8E-05	9.7E-06	3.8E-05	8.7E-04	0	0.0E+00	15.1.4.1
	5.56 BLANK	9.80E-08	2.80E-04	2.00E-05	6.00E-06	6.00E-06	1.60E-06	7.50E-06	2.00E-04	0	0.0E+00	15.1.9.1
	SRTA	0	1.6E-03	8.5E-05	3.9E-05	2.8E-05	9.7E-06	3.0E-05	8.7E-04	0	0.0E+00	
M249 SAW	5.56 BALL	0	1.6E-03	8.5E-05	3.9E-05	2.8E-05	9.7E-06	3.8E-05	8.7E-04	0	0.0E+00	15.1.4.1
	5.56 BLANK	9.80E-08	2.80E-04	2.00E-05	6.90E-06	6.00E-06	1.60E-06	7.50E-06	2.30E-04	0	0.0E+00	15.1.9.1
M240	7.62 BALL	0	4.14	1.75E-01	9.18E-02	6.84E-02	1.80E-02	9.18E-02	2.16	0	0	15.1.15.1
M203 / M320	40 MM TPT	0	3.50E-04	3.60E-05	2.60E-05	2.30E-05	3.70E-06	2.30E-05	2.60E-04	0	0.0E+00	15.2.2.1
M240 / M240B	7.62 BALL	0	2.30E-03	9.70E-05	5.10E-05	3.80E-05	1.00E-05	5.10E-05	1.20E-03	0	0.0E+00	15.1.15.1
	7.62 BLANK	3.50E-07	6.80E-04	4.40E-05	1.70E-05	1.50E-05	2.90E-06	1.70E-05	9.50E-04	0	0.0E+00	15.1.12.1
M2	.50 CAL BALL	0	1.60E-02	3.30E-05	9.70E-04	4.40E-04	5.30E-05	1.00E-03	9.20E-03	0	0.0E+00	15.1.27.1
MK 19	40 MM TPT	0	2.60E-03	9.70E-05	1.40E-04	1.20E-04	5.40E-06	1.40E-04	2.70E-03	0	0.0E+00	15.2.7.1
M274 / M267	2.75” Rocket (Inert)	0	5.30E-01	0	1.60E-01	1.70E-01	6.20E-03	1.50E-01	4.80E+00	0	7.00E-02	15.6.7
Fragmentation Hand Grenade (live)		0	1.70E-02	1.10E-03	3.10E-02	1.70E-02	2.80E-04	3.80E-02	2.40E-01	0	5.00E-04	15.5.2.1
M228 Practice Hand Grenade (5.56 Fuses)		1.10E-05	1.10E-05	4.00E-05	1.10E-04	9.40E-05	0	1.20E-04	1.70E-04	3.20E-07	0	15.5.1.1

Weapon	Ammunition Type	SO_2 (lbs/item)	CO (lbs/item)	NOx (lbs/item)	PM_{10} (lbs/item)	$PM_{2.5}$ (lbs/item)	CH_4 (lbs/item)	TSP (lbs/item)	CO_2 (lbs/item)	TNMHC (lbs/item)	Lead (lbs/item)	AP-42 Source
M84 Non-lethal Stun Hand Grenade		0	1.50E-05	4.10E-04	4.60E-03	3.30E-03	0	4.70E-03	1.70E-03	0	0	15.5.13.1
ABC-M5 30-Pound HC Smoke Pots		4.40E-03	7.90E-01	2.60E-03	32	17	0	21	4.60E-01	1.70E-02	2.40E-02	15.7.6.1
M18 Smoke Hand Grenade (various colors)		1.60E-04	1.20E-02	1.20E-04	1.30E-01	1.00E-01	0	1.30E-01	8.40E-02	2.10E-03	0	15.5.6.1
M7A3 CS Riot Control Agent Hand Grenade	CS (tear gas)	5.10E-05	3.40E-02	1.40E-03	4.20E-02	3.70E-02	0	1.80E-02	9.10E-02	5.60E-03	0	15.5.10.1
	HC (white smoke)	1.20E-04	4.60E-02	1.00E-03	6.80E-01	1.00E-01	0	4.70E-01	3.30E-02	6.30E-04	4.70E-04	15.5.5.1
M158 Star Cluster Sig0l Flare (red/white/green)[1]		1.50E-04	8.80E-03	3.30E-03	8.90E-02	0	0	9.00E-02	1.80E-01	2.80E-04	1.70E-06	15.8.2.1
M49A1 Surface Trip Flare		1.20E-04	5.30E-04	2.90E-03	1.30E-01	0	0	1.70E-01	5.20E-02	1.00E-05	9.90E-06	15.8.9.1
M115A2 Ground Burst Simulator		1.50E-04	2.10E-03	5.50E-03	1.90E-01	0	0	1.60E-01	3.40E-03	1.30E-04	4.10E-06	15.8.10.1
Booby Trap Simulator		4.40E-04	5.30E-05	5.00E-05	2.50E-03	0	0	3.20E-03	0	3.80E-06	2.30E-06	15.8.12.1
M116A1 Hand grenade Simulator		4.70E-04	3.70E-04	5.60E-03	1.20E-01	0	0	1.10E-01	4.10E-03	4.20E-05	1.40E-06	15.8.15.1
AT4 Launcher & Ctg 84mm (M136)		2.10E-05	5.50E-02	7.10E-03	6.10E-02	3.80E-02	7.40E-04	6.10E-02	4.50E-01		1.20E-03	15.6.5
Smoke Pot Flt (M4A2)		3.20E-03	8.90E-01	2.80E-03	30	23		42	5.30E-01	2.20E-02	1.60E-02	15.7.7

Weapon	Ammunition Type	SO_2 (lbs/item)	CO (lbs/item)	NOx (lbs/item)	PM_{10} (lbs/item)	$PM_{2.5}$ (lbs/item)	CH_4 (lbs/item)	TSP (lbs/item)	CO_2 (lbs/item)	TNMHC (lbs/item)	Lead (lbs/item)	AP-42 Source
BGM-71 TOW (Anti-Tank Missile)		2.10E-05	5.50E-02	7.10E-03	6.10E-02	3.80E-02	7.40E-04	6.10E-02	4.50E-01		1.20E-03	15.6.5
Carl Gustav (recoiless rifle)		2.10E-05	5.50E-02	7.10E-03	6.10E-02	3.80E-02	7.40E-04	6.10E-02	4.50E-01		1.20E-03	15.6.5
Yellow/Green/Red/Violet Smoke Grenades[2]		2.63E-04	7.27E-03	2.06E-04	1.35E-01	1.10E-01		1.12E-01	7.93E-02	9.37E-04	2.27E-05	15.5.6
Grenade Prac Fuze M228 (G878)		1.10E-05	1.10E-05	4.00E-05	1.10E-04	9.40E-05	0	1.20E-04	1.70E-04	3.20E-07	0	15.5.1.1
Artillery Simulators		1.80E-04	6.80E-03	2.00E-03	4.50E-02	4.50E-02		5.80E-02	2.50E-01	4.90E-03	1.10E-05	15.8.11
Grenade Simulators		4.70E-04	3.70E-04	5.60E-03	1.20E-01	1.20E-01		1.10E-01	4.10E-03	4.20E-05	1.40E-06	15.5.15
60mm Mortar, HE			3.00E-02	4.20E-03	3.20E-02	1.70E-02	8.40E-04	3.90E-02	2.90E-01		2.30E-04	15.2.9
60mm Mortar, Inert			7.80E-03	9.80E-05	1.40E-03	1.20E-03	2.60E-05	1.30E-03	6.30E-03		1.30E-05	15.2.11
81mm Mortar, HE			1.90E-01		1.10E-02	8.90E-03	2.80E-04	9.20E-03	1.50E-01		5.70E-05	15.3.11
81mm Mortar, Inert			4.90E-03	4.20E-05	9.50E-05	8.90E-05	1.60E-05	8.60E-05	2.90E-03		1.30E-05	15.3.12
120mm Mortar, HE			3.90E-01	3.30E-02	3.40E-01	1.70E-01	1.20E-02	4.20E-01	4.50E+00		9.70E-04	15.3.25
120mm Mortar, Inert			5.05E-01	1.29E-03	4.79E-02	4.12E-02	0.001011	5.32E-02	2.79E-01		3.33E-05	15.3.15

Weapon	Ammunition Type	SO_2 (lbs/item)	CO (lbs/item)	NOx (lbs/item)	PM_{10} (lbs/item)	$PM_{2.5}$ (lbs/item)	CH_4 (lbs/item)	TSP (lbs/item)	CO_2 (lbs/item)	TNMHC (lbs/item)	Lead (lbs/item)	AP-42 Source
Demolition, Bangalore, M026/M028/MP03		3.36E-03	5.25E-02	3.15E-02	1.26E-01	4.83E-02	0.00021	1.79E-01	3.57E+00		1.47E-03	15.9.2
Demolition, C-4, M023		1.50E-04	2.60E-02	7.90E-03	2.60E-02	1.90E-02	1.60E-03	3.20E-02	7.90E-01		1.70E-04	15.9.1
Mine, Claymore, K143/K146			2.00E-02	1.80E-02	4.90E-02	2.60E-02	3.80E-04	5.40E-02	1.60E+00		5.70E-05	15.7.3

[1] Per the USFWS Section 7 consultation, the Army will not use any illumination rounds at the IPBC until further studies have been conducted.

[2] Average of Yellow/Green/Red Smoke Grenade emission factors.

Fugitive Dust Emissions from Construction Activities

Another source of emissions identified as part of the Proposed Action includes disturbance of the area from construction activities and heavy equipment use. Short-term impacts throughout the construction period would result in emissions of fugitive dust from disturbance of the site and equipment emplacement as well as exhaust and fugitive dust emissions from the operation of heavy construction vehicles and equipment. The methods used to calculate fugitive dust emissions are discussed below. Exhaust emissions from equipment and vehicle use were not estimated because of a lack of information about what equipment and vehicles would be used during construction activities.

Construction activities for the IPBC would occupy an estimated 110 acres (44.5 ha) to construct the range. Construction of the IPBC was estimated to span 480 working days, or 240 days per year for a two year period. Emissions from construction activity are assumed to be generated during simple site grading, with no major cut-and-fill or excavation activity. Construction activities would include demolition and debris removal (e.g., bulldozing, truck loading and unloading of debris, truck travel); site preparation (bulldozing, scrapers, truck loading and unloading); and general construction (vehicular traffic). An emission factor for construction activity operations of 0.22 tons of PM_{10} per acre per month (20.95 lbs/acre/day) was used to estimate PM_{10} emissions. This is based on a recommended PM_{10} emission factor of 0.11 ton/acre/month adjusted for a worst case where no control are used assuming that standard dust control practices provide a 50% reduction in PM_{10} emissions (WRAP Fugitive Dust Handbook, 2004).

Fugitive Dust Emissions from Heavy Construction Operations

$$E_{PM10} = EF * D * A$$

$$E_{TSP} = E_{PM10} * 1.56$$

E_{PM10} = Emissions of PM_{10} (lbs/yr)

D = Number of Days of Heavy Construction Activity

A = Area Disturbed (Acres)

PM_{10} Emission Factor = 20.95 lbs/acre/day of activity) [Emission factors used are from WRAP Fugitive Dust Handbook, 2004]

Conversion factor for PM_{10} to TSP = 1.56 [Conversion factors used are from Army FEIS, Transformation of the 2nd Brigade, 25th ID (L) to a Stryker Brigade (2004)]

Conversion factor for PM_{10} to $PM_{2.5}$ = 0.1 [Conversion factors used are from Pace, Thompson, G., U.S. EPA, Examination of the Multiplier Used to Estimate $PM_{2.5}$ Fugitive Dust Emissions from PM_{10}]

Table E.7 shows the expected net increase in fugitive dust emissions for heavy construction activities for the two proposed locations within the existing impact area where the IPBC may be constructed.

Table E.7. Annual Criteria Pollutant Emissions from Heavy Construction Activities for the IPBC

Year	Disturbed Area in acres (ha)	Estimated Construction Days	Emissions					
			lb/year			tpy		
			TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$
Year 1	55 (22.25)	240	862,804.8	553,080.0	55,308.0	431.4	276.5	27.65
Year 2	55 (22.25)	240	862,804.8	553,080.0	55,308.0	431.4	276.5	27.65
Life of the Proposed Action (two years)	110 (44.5)	480	1,725,609.6	1,106,160.0	110,616.0	862.8	553.1	55.3

Construction Vehicle and Equipment Emissions

A variety of construction equipment and vehicles are expected to be used for construction activities supporting the IPBC including bulldozers, graders, rollers, trucks, and generators. Emissions from the exhaust of construction equipment and vehicles were calculated using the number of equipment, horsepower of the equipment, and estimated operating time multiplied by an emission factor. Emission factors were derived from the California Air Resources Board In-Use Off-Road Equipment (Construction, Industrial, Ground Support and Oil Drilling) model for 2011 (see Table E.8). Emission factors for generators were obtained from EPA's *AP-42, Compilation of Air Pollutant Emission Factors* (Table 3.3 Gasoline and Diesel Industrial Engines).

Emissions from Construction Vehicles and Equipment

$$E_{eq} = EF * hp * hr * N$$

E_{eq} = Emissions of equipment/vehicles (tons/yr)

hr = Number of hours per year equipment/vehicles operate

hp = horsepower of the equipment/vehicle

N = number of equipment/vehicles

$PM_{2.5}$ is 92% of PM_{10} per California Air Resources Board In-Use Off-Road Equipment model

Table E.8. Criteria Pollutant Emission Factors for Construction Vehicles and Equipment Exhaust Emissions

Equipment	Equipment Quantity	Engine (hp)	Fuel Usage (gal/hr)	Hours	Total Fuel (gal)	NOx (lb/hp-hr)	PM_{10} (lb/hp-hr)	HC (lb/hp-hr)
Construction Equipment								
825 compactor	1	401	11	792	8712	0.00497	0.00019	0.00029
D4 dozer	1	92	2	1584	3168	0.00828	0.00073	0.00087
D5 dozer	1	105	3	1584	4752	0.00828	0.00073	0.00087
D10 dozer	1	700	16	1584	25344	0.00652	0.00024	0.00038
Smooth drum roller	1	150	4	792	3168	0.00445	0.00021	0.00029
962G loader	1	200	13	1584	20592	0.00467	0.00016	0.00027
966 loader	1	220	6	1584	9504	0.00467	0.00016	0.00027
980GII loader	1	323	8	1584	12672	0.00446	0.00017	0.00029
988G loader	1	555	7	1584	11088	0.00405	0.00016	0.00027
613 scraper	1	150	5	1584	7920	0.00908	0.00048	0.00068
14G blade grader	1	180	6	1584	9504	0.00342	0.00017	0.00028
365 excavator	1	411	11	1584	17424	0.00342	0.00011	0.00018
345 excavator	1	345	9	1584	14256	0.00342	0.00011	0.00018
330 excavator	1	235	7	1584	11088	0.00448	0.00014	0.00024
185 compressor	1	78	7	1056	7392	0.00637	0.00050	0.00058
Water pump	1	100	3	1056	3168	0.00633	0.00033	0.00046
Crusher	1	250	14	800	11200	0.00614	0.00024	0.00036
Construction Vehicles								
Lube truck	1	250	11	528	5808	0.00542	0.00023	0.00038
Mechanic truck	1	250	7	528	3696	0.00542	0.00023	0.00038
Water truck	2	250	18	2112	38016	0.00542	0.00023	0.00038
Ford Explorer	1	250	2	1056	2112	0.00542	0.00023	0.00038
F150 2x4	1	300	2	1056	2112	0.00453	0.00018	0.00031
F150 4x4	1	300	2	1056	2112	0.00453	0.00018	0.00031
F250 4x4	1	350	3	1056	3168	0.00453	0.00018	0.00031
F350 4x4	1	400	3	1056	3168	0.00453	0.00018	0.00031
Truck 20T	5	250	9	3000	27000	0.00542	0.00023	0.00038
Generators								
100kw genset	1	250	5	1056	5280	0.031	0.0022	0.00247
500KW genset	1	749	25	80	2000	0.031	0.0022	0.00247

Table E.9 shows the expected emissions for construction equipment and vehicles used to construct the IPBC.

Table E.9. Annual Exhaust Emissions Estimated from Construction Vehicles and Equipment used During the Construction of the IPBC

Equipment	NOx (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	HC (tpy)
Construction Equipment				
825 compactor	0.79	0.03	0.028	0.05
D4 dozer	0.60	0.05	0.049	0.06
D5 dozer	0.69	0.06	0.056	0.07
D10 dozer	3.61	0.13	0.122	0.21
Smooth drum roller	0.26	0.01	0.012	0.02
962G loader	0.74	0.03	0.023	0.04
966 loader	0.81	0.03	0.025	0.05
980GII loader	1.14	0.04	0.040	0.07
988G loader	1.78	0.07	0.065	0.12
613 scraper	1.08	0.06	0.052	0.08
14G blade grader	0.49	0.02	0.022	0.04
365 excavator	1.11	0.04	0.033	0.06
345 excavator	0.93	0.03	0.028	0.05
330 excavator	0.83	0.03	0.024	0.04
185 compressor	0.26	0.02	0.019	0.02
Water pump	0.33	0.02	0.016	0.02
Crusher	0.61	0.02	0.022	0.04
Construction Equipment Subtotal	16.09	0.69	0.63	1.05
Construction Vehicles				
Lube truck	0.36	0.02	0.014	0.02
Mechanic truck	0.36	0.02	0.014	0.02
Water truck	2.86	0.12	0.113	0.20
Ford Explorer	0.72	0.03	0.028	0.05
F150 2x4	0.72	0.03	0.026	0.05
F150 4x4	0.72	0.03	0.026	0.05
F250 4x4	0.84	0.03	0.030	0.06
F350 4x4	0.96	0.04	0.034	0.06
Truck 20T	10.16	0.44	0.402	0.71
Construction Vehicles Subtotal	17.68	0.75	0.69	1.23
Generators				
100kw genset	4.09	0.29	0.267	0.33
500KW genset	0.93	0.07	0.061	0.07
Generators Subtotal	5.02	0.36	0.33	0.40
Total (tons)	**38.80**	**1.79**	**1.65**	**2.68**
Total (tpy)	**19.40**	**0.90**	**0.83**	**1.34**

Emissions from Employee Commuting (POVs)

Additional sources of emissions identified as part of the Proposed Action include commuter vehicles. Criteria pollutant and GHG emissions from vehicle exhaust have been estimated for support personnel traveling to and from the IBPC on unpaved roads. The methods used to calculate emissions from these sources are discussed below.

The IPBC would be contractor run and personnel would drive their own vehicles to the ranges (POVs). Three (3) additional support personnel are expected to be required to operate the IPBC when the range is open (242 days per year). It was assumed that all POVs will be light duty trucks with a fuel economy of 16.2 miles per gallon (DOE, 2010). Emissions from commuter vehicular traffic traveling to and from the proposed range locations were calculated based on the assumptions in Table E.10.

Table E.10. POV Commuting Profile

Range Location	Average Speed (mph)	Vehicle Fuel Economy (mpg)	Estimated Round-trip from Cantonment Area
Western Range	30	16.2	14 miles (22.5 km)
Charlie's Circle	30	16.2	13 miles (21 km)

Employee Commuting Criteria Pollutant Emissions

$$E_{POV} = VMT_{POV} * EF * .002205$$

E_{POV} = emissions of criteria pollutant generated by POVs

EF = EPA emission factor for light-duty truck vehicle category (grams/mile) [Emission factors used are from IERA AEI Guidance for Mobile Sources Rev. 2003 Tables 4-2, 4-3, and 4-4 as shown in Table E.11]

VMT_{POV} = estimated vehicle miles traveled

0.002205 = factor to convert grams to pounds

Table E.11 identifies the emission factors for personal vehicle use. Table E.12 shows the expected net increase in annual exhaust emissions from POVs traveling to the proposed locations within the existing impact area where the IPBC may be constructed.

Table E.11. Emission Factors for Personal Vehicle Use

Trucks (Low Altitude LDGT1)	Emission Factors (g/mi)		
	VOC	NOx	CO
2009 MY 2001	2.4	1.9	28.3

Table E.12. Annual Criteria Pollutant Emissions from Personnel Commuting to IPBC from the Cantonment Area

Location	Emissions (lbs)			Emissions (tons)		
	VOC	NOx	CO	VOC	NOx	CO
Western Range Area	99.9	79.1	1,177.9	0.05	0.04	0.59
Charlie's Circle	103.7	82.1	1,223.2	0.05	0.04	0.61

Employee Commuting GHG Emissions

Calculations of GHG emissions from the mobility energy sources followed The Climate Registry protocol which estimates emissions of GHGs from mobile combustion sources based on vehicle fuel use and miles traveled data. The majority of mobile source emissions are from CO_2, methane (CH_4), and nitrous oxide (N_2O) and associated with the quantity of fuel combusted; therefore, emissions can be calculated using fuel consumption data. Annual GHG emissions are then calculated by multiplying the total fuel consumed by a GHG specific emission factor. The individual GHG emissions were converted into a CO_2-equivalent (CO_2-e) based on global warming potentials (GWP). The cumulative warming effect over a specified time period of an emission of a mass unit of $CO_2$is assigned the value of 1. Effects of emissions of a mass unit of non- CO_2GHG are estimated as multiples of CO_2. For example, CH_4 has a GWP of 21, which means that 1 kg of CH_4 has the same heat-trapping potential as 21 kg of $CO_2$and N_2O has a GWP of 310 (IPCC, 2007).

$$\mathbf{E_{GHG} = Fuel\ Use \times EF_{GHG}}$$

for CH_4 and N_2O

$$\mathbf{Fuel\ Use = VMT_{POV} \times Fuel\ Economy}$$

E_{GHG} = GHG emissions generated by POV commuting.

EF_{GHG} = Emission factor for combustion of gasoline (kg/gallon or grams/liter)

Fuel Economy = 16.2 mph for light-duty trucks (DOE, 2010)

VMT_{POV} = estimated vehicle miles traveled per year

Table E.13 identifies the emissions factors specific to the fuel from generally accepted GHG protocols. Table E.14 shows GHG emissions (e.g., CO_2, CH4, and N_2O) calculated for employee commuting by type of fuel combusted and applying the emissions factors in Table E.11.

Table E.13. GHG Emission Factors for Combustion of Gasoline

Vehicle	Fuel	Emission Factor		
		CO_2 (kg/gal)	CH_4 (g/L)	N_2O (g/L)
Light Duty Truck	Gasoline	8.81	0.22	0.32

Table E.14. Annual Commuting Personnel GHG Emissions

Location	Emissions Calculations (MT/yr)			CO_2-e Calculations (MT/yr)			Total CO2e MT/yr
	CO_2	CH_4	N_2O	CO_2	CH_4	N_2O	
Western Range Area	22,635.0	565.2	822.2	11.3	0.28	0.41	12.01
Charlie's Circle	23,505.5	587.0	853.8	11.8	0.29	0.43	12.47